# ASTM Gasoline Volatility Standards[1]

In addition to ARB's gasoline regulations which appear in Title 13, California Code of Regulations, Sections 2250-2272, the California Business and Professions Code (B&PC) requires gasoline and gasoline-oxygenate blends to meet the latest specifications set forth in the American Society for Testing and Materials (ASTM) Standard Specification for Automotive Spark-Ignition Engine Fuel (Designation: D 4814). The California Department of Food and Agriculture (DFA) is responsible for the enforcement of this requirement. Under this standard, volatility of fuels is varied for seasonal climatic changes and conformance to U.S. EPA volatility regulations by providing six vapor pressure/distillation classes and five vapor lock protection classes. Fuel volatility requirements are specified by an alphanumeric designation that uses a letter from Table 1 and a number from Table 2. The seasonal and geographic distribution of the combined vapor pressure/distillation-vapor lock classes is shown in Table 3. ASTM climatalogical divisions result in four geographic areas shown in Figure 1.

**Table 1**
**Vapor Pressure and Distillation Class Requirements**
(Specification set forth in ASTM D 4814)

| Vapor Pressure/ Distillation Class | Vapor[A] Pressure, max, psi | Distillation Temperatures, °F, at % Evaporated[B, C] | | | | | Distillation Residue, vol %, max |
|---|---|---|---|---|---|---|---|
| | | 10 vol % max | 50 vol % min | 50 vol % max | 90 vol %, max | End Point max | |
| AA | 7.8 | 158 | 170 | 250 | 374 | 437 | 2 |
| A | 9.0 | 158 | 170 | 250 | 374 | 437 | 2 |
| B | 10.0 | 149 | 170 | 245 | 374 | 437 | 2 |
| C | 11.5 | 140 | 170 | 240 | 365 | 437 | 2 |
| D | 13.5 | 131 | 170 | 235 | 365 | 437 | 2 |
| E | 15 | 122 | 170 | 230 | 365 | 437 | 2 |

A California Reformulated Gasoline Regulations specify a maximum Reid vapor pressure of 7 psi during Regulatory Control Periods which are established for each air basin. Basic Regulatory Control Periods begin on the first day of April, May, or June, and end on the last day of September or October. Additional Regulatory Control Periods begin one month earlier.

B At 14.696 psi pressure (101.3 kPa, 760 mm Hg). Pressure Conversion: kPa = (psi)(6894.8) / (1000); mmHg = (psi) / (0.019267)

C California Reformulated Gasoline Regulations specify maximum distillation temperature standards (T90$\leq$330°F, T50$\leq$220°F) which are applicable statewide, year-round. Temperature Conversion: °C = (°F - 32°) / (1.8)

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1 The information presented here was extracted from ASTM D 4814-95b and is not all inclusive. It is intended only to provide assistance in understanding the overlapping relationship between ARB and DFA volatility requirements.

**Table 2**
**Vapor Lock Protection Class Requirements**
(Specification set forth in ASTM D 4814)

| Vapor Lock Protection Class | Vapor/Liquid Ratio (V/L)[A] | |
|---|---|---|
| | Test Temperature, °F | V/L, max |
| 1 | 140 | 20 |
| 2 | 133 | 20 |
| 3 | 124 | 20 |
| 4 | 116 | 20 |
| 5 | 105 | 20 |

[A] At 14.696 psi pressure (101.3 kPa, 760 mm Hg).

**Table 3**
**Schedule of Seasonal and Geographical Volatility Classes[A]**
(Specification set forth in ASTM D 4814)

| Climatological Division | Jan. | Feb. | Mar. | Apr. | May[B] | June | July | Aug. | Sept. 1-15 | Sept. 16-30 | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North Coast | E-5<br>D-4 | D-4 | D-4 | D-4<br>A-3 | A-3<br>(C-3) | A-3[C] | A-2[D] | A-2[D] | A-2[D] | A-2<br>B-2 | B-2<br>C-3 | C-3<br>D-4 | D-4<br>E-5 |
| South Coast | D-4 | D-4 | D-4<br>C-3 | C-3<br>A-3 | A-3<br>(C-3) | A-2[D] | A-2[D] | A-2[D] | A-2[D] | A-2<br>B-2 | B-2<br>C-3 | C-3<br>D-4 | D-4 |
| Southeast[E] | D-4 | D-4<br>C-3 | C-3<br>B-2 | B-2<br>A-2 | A-2<br>(B-2) | A-1[F] | A-1[F] | A-1[F] | A-1[F] | A-1 | A-1<br>B-2 | B-2<br>C-3 | C-3<br>D-4 |
| Interior | E-5<br>D-4 | D-4 | D-4 | D-4<br>A-3 | A-3<br>(C-3) | A-2[D] | A-2[D] | A-2[D] | A-2[D] | A-2<br>B-2 | B-2<br>C-3 | C-3<br>D-4 | D-4<br>E-5 |

A For the period May 1 through September 15, the specified vapor pressure classes comply with 1992 U.S. EPA Phase II volatility regulations. EPA regulations allow 1.0 psi higher vapor pressure for gasoline-ethanol blends containing 9 to 10 percent by volume ethanol for the same period. Where two classes are specified for a given month, either class is permitted.

B Values in parentheses are permitted for retail stations and other end users.

C AA-3 for the following ozone nonattainment areas: Monterey Bay, San Francisco-Bay Area.

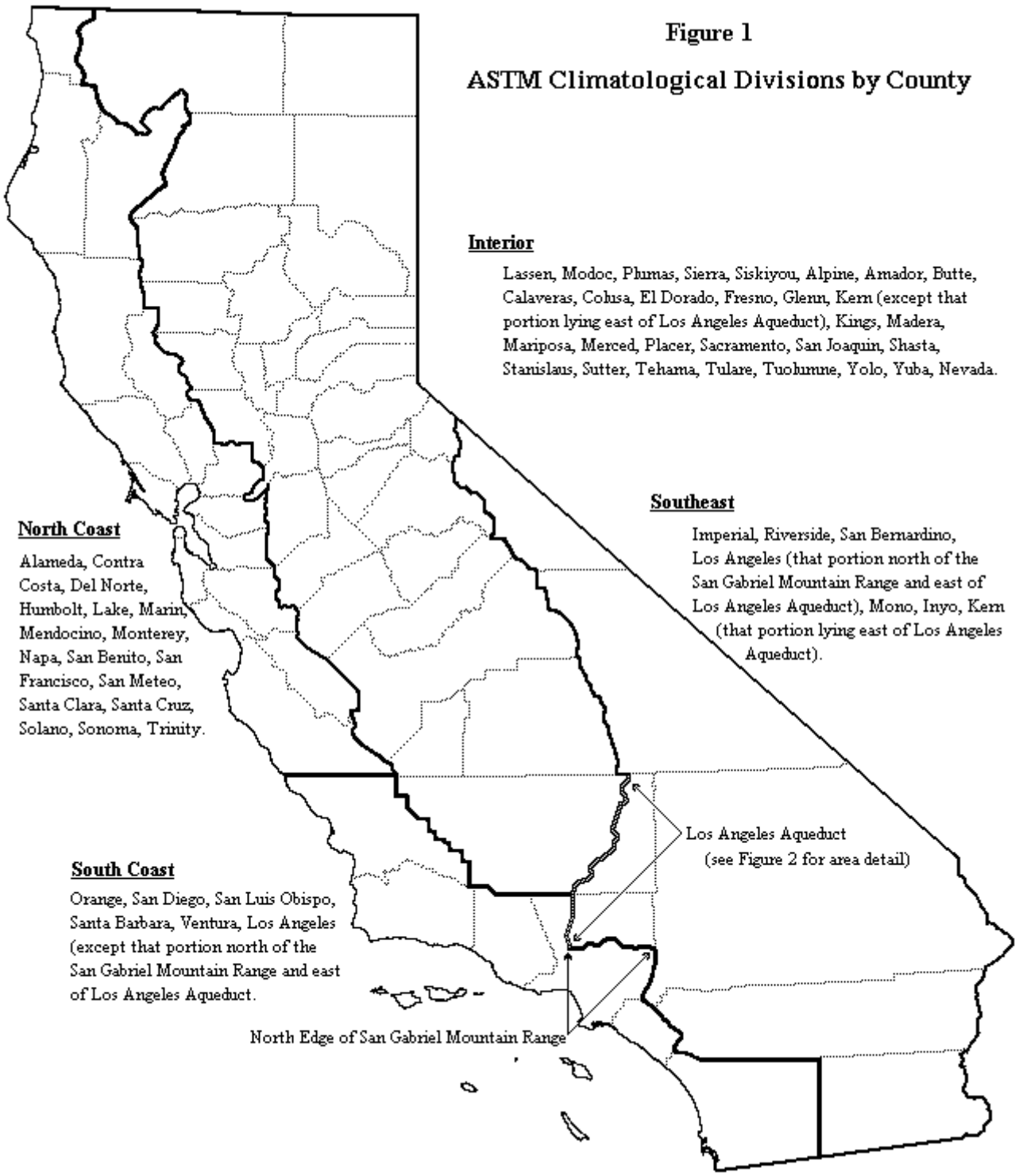
D AA-2 for the following ozone nonattainment areas: Chico, Los Angeles-South Coast Air Basin, Monterey Bay, Sacramento Metro, San Diego, San Francisco-Bay Area, San Joaquin Valley, Santa Barbara-Santa Maria-Lompoc, Ventura County, Yuba City.

E Pursuant to California B&PC Section 13440, gasoline sold for use in Inyo or Mono County, or the portion of Kern County lying east of the Los Angeles Aqueduct, shall comply with the volatility class standards for the season during which the gasoline is sold for either the interior region or the southeast region of California.

F AA-1 for the following ozone nonattainment areas: Imperial County, Southeast Desert Modified AQMA.

## Figure 1

## ASTM Climatological Divisions by County



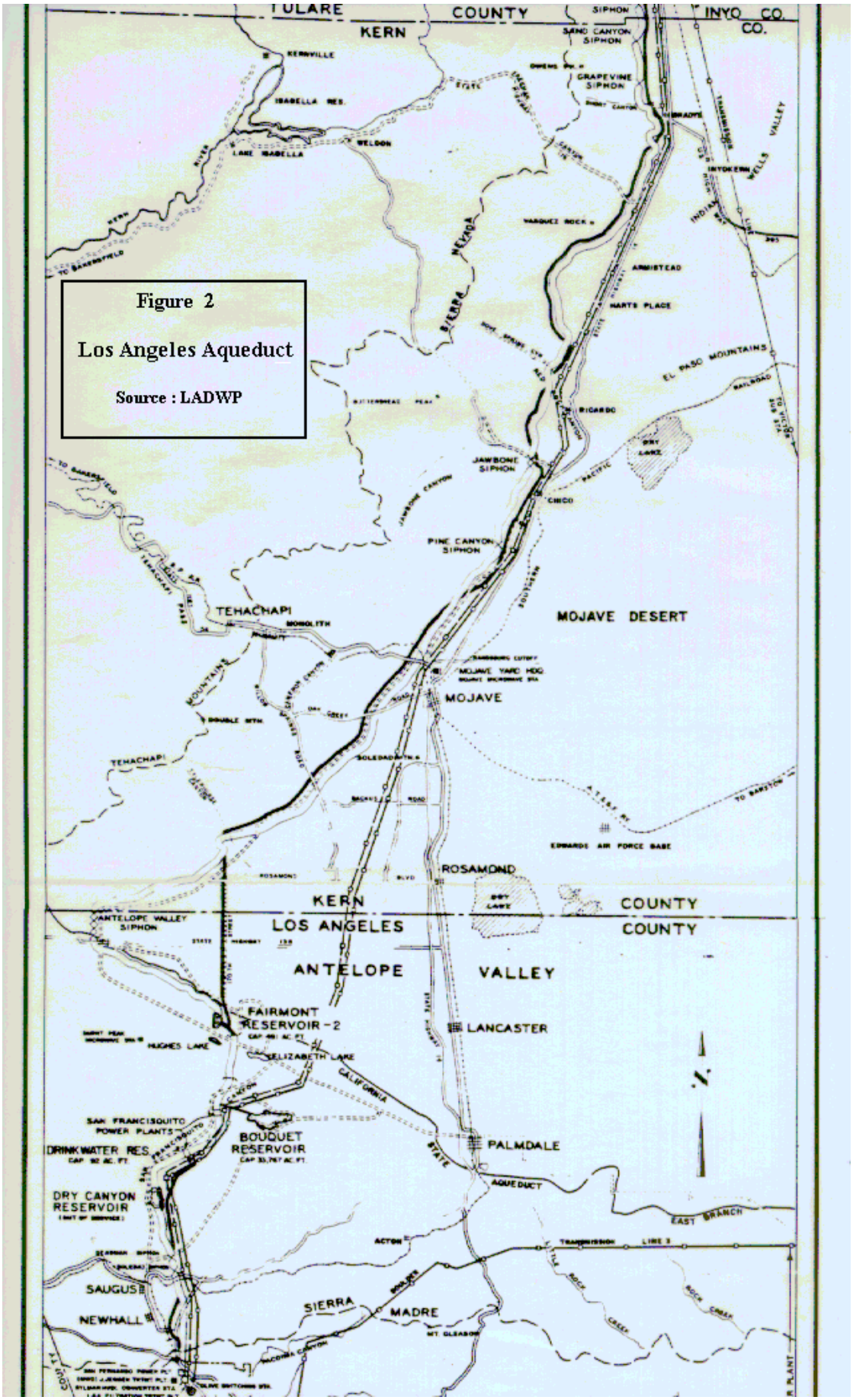



**Figure 2**

**Los Angeles Aqueduct**

**Source : LADWP**